TN TDOT Department of Transportation

Research Summary

The Impacts and Adoption of Connected and Automated Vehicles in Tennessee

Project Number:
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WHAT WAS THE RESEARCH NEED?

In 2017, the transportation sector reported 39,141 fatalities, and ~89% of these fatalities were because of driver-related errors where impaired driving and speeding were among the major causes (~32% and ~29% respectively). In addition to reducing human error-related accidents, Connected and Autonomous Vehicles (CAVs) can revolutionize the way we travel through increased productivity during travel. Despite the commitments from governments and industries in allowing open road CAV testing and investing in development to push CAV's market penetration by 2025, user acceptance is still uncertain. The state of Tennessee welcomes CAVs for testing and operation on public roads, making it more important to study the anticipated adoption of CAV in the state. Existing research indicates the importance of peer-to-peer interaction on the acceptance of novel technological innovations. However, recent research on CAV adoption fails to capture such impacts.

WHAT WERE THE RESEARCH OBJECTIVES?

Building upon the existing literature, the objectives of this project were:

1. To explore the current status of literature.
2. To design and conduct a statewide survey to record residents' perceptions, barriers, and adoption preferences towards CAVs.
3. To analyze the survey responses and estimate these to the entire population of Tennessee.

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4. To explore the impact of peers in social network, social status, and positive and negative impacts of CAVs on their anticipated adoption of CAVs.
5. To forecast and showcase CAV adoption levels at both state and county level.
6. To Identify the key policy implications based on the modeling and adoption forecasts and propose recommendations to boost the acceptance of CAVs in Tennessee.
7. To explore the status of CAVs in the context of COVID-19 and propose recommendations.

WHAT WAS THE RESEARCH APPROACH?

To capture the objective and obtain the individuals' preferences towards CAVs, a statewide SP survey was conducted. The survey process included three interdependent elements: Sampling methodology, Survey methodology, and a Survey instrument. The survey dataset was utilized to generate the R-shiny web dashboard to visualize the survey results for a larger population. The dataset was then split for cross-validation purposes. The project then developed fusion of agent-based and hybrid choice models that can capture the impact of word-of-mouth (peer-to-peer interaction) and perceptions towards CAV-related positive and negative impacts. The model is also capable of forecasting the future market share of CAVs for the state of Tennessee.

WHAT WERE THE FINDINGS?

Among the results, in the hybrid choice model, six attitudinal constructs were identified: Social status, Social Influence, CAV Benefits, CAV Barriers, CAV Purchase, and Media Influence. Residents of all ages and income levels were concerned about all six attitudinal constructs, highlighting the importance of peer-to-peer interaction, media advertisements, and factors including positive, negative, and purchase characteristics of CAVs. Individuals who do not receive any CAV-related information from their peers were shown to rely on media advertisements. Individuals willing to pay higher for autonomous technology, following a tech-confident lifestyle, and feeling concerned about all six attitudinal constructs were more likely to adopt all five CAV-based travel modes.

IMPLEMENTATION AT TDOT

Based on the findings of privately owned CAVs, we propose some policy recommendations to boost their market share in Tennessee. The main recommendation is to focus on a public awareness strategy related to CAVs. As per this strategy, counties identified with low CAV acceptance rates can be targeted in the initial stages. The lessons and impacts of awareness strategies on these counties can then be applied to statewide awareness strategies. At the program level, the awareness strategy might focus on the potential of CAVs in eliminating human-related errors, lower insurance premiums, the ability to multitask while driving, and providing mobility to the disabled. In addition, the focus can be on educating the general public about cybersecurity, data privacy, and safety-related aspects of CAVs. During the post-introduction phase of CAVs, the public awareness strategy should be coupled with government incentives to residents interested in adopting CAVs and integrating CAVs into the existing infrastructure facilities. Integrating CAVs with existing infrastructure and intelligent transportation systems like TDOT SmartWay can decrease the operational cost of CAVs.

MORE INFORMATION

Find the final report here: https://www.tn.gov/content/dam/tn/tdot/long-range-planning/research/final-reports/res2019-final-reports/RES2019-06_Final%20Report%20Approved_ReducedFileSize.pdf.

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